



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/530,612	12/30/2005	Franz Laermer	10191/3964	6739
26646	7590	10/11/2006	EXAMINER	
KENYON & KENYON LLP ONE BROADWAY NEW YORK, NY 10004			ANGADI, MAKI A	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 10/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/530,612

Applicant(s)

LAERMER ET AL.

Examiner

Maki A. Angadi

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-32 and 40 is/are rejected.
- 7) ☐ Claim(s) 33-39 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4/7/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 21-32 rejected under 102(e) as being unpatentable over Donohue (US Patent No. 6,071,822) in view of Donohoe (US patent No. 6,890,863).

As to claim 21, 23 and 30, Donohue (I) discloses a method and a system that reads on the process of anisotropically etching structures (col.1, lines 9-12) into a substrate (col.1, lines 41-43)(Fig.1) positioned in an etching chamber

Art Unit: 1765

(col.1, lines 43-45) in particular structures using an etching mask (col.1, lines 23-25) in a semiconductor substrate, using a plasma (col.1, lines 41-46), the intermittent use of passivation and etching gas cycles in the plasma chamber (col.4, lines 30-38, lines 45-48).

Donohue does not expressly disclose the time period of the passivation gas cycles. However, Donohoe discloses the passivation gas cycles having a time period between 1-30 seconds (col.10 lines 7-22), which covers the range cited by the applicant. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the anisotropic etching process used by Donohue to include period of the passivation gas cycles because Donohoe illustrates that the intermittent use of passivation gas cycles moderates etch rate (col.10, lines 3-6).

As to claim 22, Donohue discloses the cycle between 1-30 seconds, which is within the approximate range of 0.1 seconds to 0.5 second. The etching time depends on several parameters such as substrate morphology, substrate material and etchant. One who is skilled in the art at the time the invention was made would be able to optimize duration of etching by routine experimentation. See MPEP § 2144.05 II

As to claim 24 and 40, Donohue discloses a method that reads on the process of permitting the etching gas (col.11, lines 45-46) and passivation gas

Art Unit: 1765

(col.12, lines 21-23) used alternately during separate etching steps and passivation steps (col.11, lines 12-31) which are controlled independently on one another (col.11, lines 45-57), passivation gas being supplied to the etching chamber largely only during the passivation gas steps (col.12, lines 16-35), the etching gas being supplied to the etching chamber (20) (Fig.1) during the etching steps (col.11 lines 45-52).

As to claim 25, Donohue discloses the passivation gas such as, $C_2H_2F_4$, C_3F_8 and C_4F_8 as passivation gases.

As to claim 26, Donohue discloses a method that reads on the process of permitting the etching gas (col.11, lines 45-46) and passivation gas (col.12, lines 21-23) used alternately during separate etching steps and passivation steps (col.11, lines 12-31), a polymer, in particular a Teflon-like polymer (col.12, lines 45-48), being applied to the lateral delimitation of the structures (col.12, lines 11-14) defined by the etching gas, with the aid of the passivation gas during the passivation steps (col.12, lines 21-29), the polymer being at least partially eroded during the following etching step and redeposited in lower regions of the produced structure (col.12, lines 24-27).

As to claim 27, Donohue discloses the duration of passivation step typically for about 5 seconds and etching step for about 2-6 seconds, which do

not differ by a factor of about 10-30. The duration of the passivation and etching steps are dependent on several factors such as etching gas, plasma power density, and the thickness of the polymer layer which are experimental variables that can be optimized depending on the desired outcome for an anisotropic etching of structures. One who is skilled in the art at the time of invention was made would be motivated to optimize through routine experimentation of etching conditions. See MPEP § 2144.05 II.

As to claim 28, Donohoe discloses high-density plasma using magnets to increase the ion density (col.8, lines 1-2) but does not specify the actual value of the ion density. However Donohue discloses ion energy from 5 to 30 eV (col.11, lines 20-24) and ion density of about 10^9 ions/cm³ (col.4, lines 14-15). Moreover, Donohue teaches that ion density is the most influential factor in anisotropic etch of trench which can easily be controlled as it is directly proportional to ion current (col.6, lines 17-20). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize ion density values in the plasma etch process through routine experimentation. See MPEP § 2144.05 II.

As to claim 29, Donohue discloses that the amount of passivation gas used during each of the individual passivation steps is in the range 0-100 sccm (col.8, lines 24-28). Donohue does not expressly disclose the passivation gas being reduced continuously or in steps. Donohoe discloses the use of

programmable computer to monitor the pressure chamber, evacuation of chamber, flow rate and other operations in the plasma chamber (col.8, lines 41-49). Therefore, it would have been obvious to one of ordinary skill in the art at the time invention was made to optimize the passivation gas in the passivation step through experimentation. See MPEP § 2144.05 II.

Claim Rejections - 35 USC § 103

2. Claims 31-32 rejected under 102(e) as being unpatentable over Donohue (US Patent No. 6,071,822) in view of Donohoe (US patent No. 6,890,863) as applied to claim 10 above, in further view of Puech (US patent No. 6,431,113).

Donohue does not expressly disclose detailed operating conditions of a plasma reactor. However, Puech discloses the details of the etching chamber that read on (Fig.1) pump device for evacuating the chamber in such a way that the etching gas and the passivation gas are supplied to the etching chamber alternately during separate, independently controlled etching and passivation steps, and the etching chamber is at least approximately free of the passivation gas during the etching steps, at least in the region in which the plasma source acts on the etching gas, and etching chamber is at least approximately free of the etching gas during the passivation steps, at least in the region in which the plasma source acts on the passivation gas (col.4, lines 40-67 and col.5, lines 1-28). Therefore, it would have been obvious to one of ordinary skill in the art at the

time the invention was made to modify a plasma system used by Donohue that controls the gas manifold to alternate etch and passivation steps because Puech illustrates that the additional control features of the plasma system would enable quick variation of the flow of active gases in the vacuum enclosure for treatment of a substrate without interfering with the means for controlling and regulating ionic bombardment of the substrate (col.3, lines 1-4).

Claim 30 is rejected in view of rejection of claims 21, 23-29.

Allowable Subject Matter

3. Claims 33-39 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The combined reference of Donohue, Donohoe and Puech fail to disclose or suggest the following steps in claims 33-39:

With respect to claim 33, the presence of buffer tank and rapid switching of downstream passivation gas valve.

With respect to claim 34, interruption of etching gas before passivation gas is supplied to the etching chamber.

With respect of claim 35, positing etching gas valve at a distance of less than 20 cm from the passivation gas valve.

Art Unit: 1765

With respect to claim 36, etching and passivation gas valve combined into one changeover valve.

With respect to claim 37, buffer tank with a volume of 0.1L to 1L.

With respect to claim 38, high voltage generator with a power per area more than 5 watts/cm² and in particular 15 watts/cm².

With respect to claim 39, having two coils enclosing chamber externally with current flowing in opposite directions in pairs.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chen (US Patent No. 5,868,853) discloses an integrated film etching/chamber cleaning process.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maki A. Angadi whose telephone number is 571-272-8213. The examiner can normally be reached on 8 AM to 4.30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public

Art Unit: 1765

PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Dr. Maki Angadi
Examiner
Art Unit 1765

A handwritten signature in black ink, appearing to read 'Shamim Ahmed', with a stylized, looping flourish at the end.

**SHAMIM AHMED
PRIMARY EXAMINER**